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Sound, which we knew was clear of ice, to try to find any of the government stores that were left for Sir John Franklin; but we had not proceeded far before the crew mutinied, and we turned back and took the pack. Whilst sailing south, with every available sail set, and driving the ship and forcing her through the ice for life or death, we saw the steam-ship *Diana* of Hull, beset in the ice off the River Clyde, but could render her no assistance. She drifted in the pack to the south, and after a few months' delay arrived at home, crushed and leaky, her captain and many of her crew dead, and others dying. To Mr. Smith, her surgeon, whose acquaintance I made at this anxious time, and who is now medical officer to Mr. Lamont's expedition to Spitzbergen may be attributed the credit of her being brought home at all.

Our vessel, the *Queen*, arrived in Cumberland Gulf, and made a tour of it, she then anchored in Nieuatlik Harbour to prepare for sea, after which she made a quick passage home, having been absent nearly nineteen months.

During the voyage we satisfactorily determined—

I. That the land on which Cape Horsburgh is situated is an island.

II. That there is open water all the year round at the mouth of Lancaster Sound.

III. That there are no natives or deer on North Devon.

Our voyage also is of interest, on account of the high latitude we wintered in ($74^{\circ} 44' 24''$ N.), and because we are able to tell the state of the ice, as far 90° west longitude, in Lancaster Sound and in Prince Regent's Inlet, and so increase the number of journeys made to these rarely visited parts, and thereby assist the statistics. And lastly, we found for a fact that white whales and walrus are in $74^{\circ} 45'$ N. lat. as late as October 12th.

9. *Hydrographical Survey of Ladoga Lake.* Translated from the Russian of A. ANDREYEFF. By E. DELMAR MORGAN, F.R.G.S., late H.B.M. Acting Vice-Consul at Onega.

WE are accustomed to hear that the Ladoga Lake is stormy, full of rocks and dangerous shoals, and that its navigation is fraught with danger. But this widely spread opinion is not quite accurate. The chief obstacle to the navigation of the lake has been that hitherto no good description of it has been written, and no full and accurate chart drawn out. It was not until very recently that a hydrographical survey of the lake was made by a special commission whose labours are now concluded.

And yet the Ladoga Lake from time immemorial served as a means of communication between the Slaves of Ilmen on the one side, and the Variagas, and subsequently the German trading towns, on the other. Owing to this the Ladoga Lake is mentioned in Nestor's manuscripts under the name of Nevo. Upon the invitation of the Variago-Russ by the Slaves in the year 862, Rurik built his town of Aldeaborg (Ladoga) near the bank of the Volchoff, 12 versts from the lake. The lake itself is mentioned in the commercial treaty made in 1201 between the Gothlanders and the Novgorodians under the names Alda, Aldesk, Aldagen; and not until 1228, in the time of Kniaz George II. Vsevolodovitch, do we hear of it under the name of Ladoga.

During the development of trade between Novgorod and the Hanseatic towns, the Ladoga Lake formed part of the water communication by means of which this larger trade was carried on; and the whole water-way between Novgorod and the Gulf of Finland was known under the name of the "Novgorodian." The great importance attached to this channel for trade gave rise, as early as the commencement of the twelfth century, to contention between the Swedes and the Russians for its possession, but especially for that part of

it formed by the banks of the Neva and Ladoga Lake. The principal points at which this struggle was most obstinate and severe were,—the embouchure of the Volchoff into the Ladoga Lake (site of the town of old Ladoga), the source of the Neva in the lake (where in 1323 the town of Oréshék existed) and lastly the embouchure of the Neva into the Gulf of Finland. With the fall of Novgorod and the discovery by the English of a sea-route to Russia by the White Sea in the sixteenth century, the importance of the Novgorodian water-way diminished, and the Swedes were enabled to remain masters of the Neva and Ladoga Lake till Peter the Great restored to Russia her former possessions.

Unfortunately there are no reliable data as to the build and size of the vessels employed on the Ladoga at the time it formed part of Russia's most important highway for commerce. In the neighbouring monasteries, however, are sometimes to be found old drawings and models, the works of the religious inhabitants, representing a kind of craft which exactly resembles the soimas* of the present day. This fact, and also the primitive character of the modern soima, leads one to infer that the Novgorodians employed craft of the same kind as the soimas of the present day.

The Ladoga soima is made of the wood of the place, and entirely without nails, which are replaced by thongs, made of the fibrous roots of trees, so that there is no metal nail, bolt, or pin about it; notwithstanding this, it is an excellent craft for coasting purposes, being cheap, strong, light in the draught, capable of taking a good cargo, fast, and a good sea-boat; its lines are good, and it is as serviceable under oars as under sail.

In this state Peter the Great found the ship-building on the Ladoga Lake. With a view to building a fleet, he sent, as early as 1702, a commission to the River Pásha, where, time out of mind, the vessels which floated on these waters were built. The Commission had orders to inquire into every particular about ship-building, and to take soundings on the Rivers Pásha, Oyata, and Svir. Having travelled abroad and learned the art of ship-building in Holland, Peter the Great found the Ladoga craft unsuitable, and he therefore selected a place on the Svir at Lodeinaya Polia,† where he constructed a dock for building vessels adapted to warlike purposes.

Somewhat later there appeared on the lake, for coasting purposes, galleots and craft of a very Dutch-like construction, which have continued from that time down to the present.

Peter I. was indefatigable in visiting the docks and watching the ship-building. He entered into every detail for fitting out the new vessels, and tried their qualities when completed, surveyed the water in several places near Kotlin and in the Neva at the rapids of Pell, and once actually tried to sail from the Svir to Ladoga in a galleot; unfortunately, his galleot grounded on an unknown shoal in the lake not far from Svir, and no efforts could take her off. This shoal is still known under the name of the Imperial or Tsar's shoal. Here the Emperor left the galleot and set out in a small boat for Svir, on the way to which place he was overtaken by a violent storm.

This episode in the life of Peter the Great is well known, and history affirms that on reaching shore the Emperor determined to punish the lake,—a threat which the ignorant peasants understood to have a literal signification, but which, no doubt, referred in his own mind to a careful survey of it.

It is much to be regretted that Peter the Great's intentions on this head remained unfulfilled. It is evident from the archives of the Hydrographical Department of the Ministry of Marine that no survey was made of the lake up to the year 1763.

* The soima is a kind of decked boat used on the Ladoga Lake. † Field of Lodi.

These archives contain four charts of the Ladoga Lake, made at different times, but one of which is useful for navigating purposes, namely, that published in 1845 by the Hydrographical Department, compiled from Schubert's Trigonometrical and the Topographical Surveys in 1824 of the south shore, and Steingel's Military Survey in 1797 of the Finnish coast.

Even this chart is very imperfect, owing to its not showing many of the shoals near the southern shore of the lake; the Finnish islands are not marked on it, as they formed no part of a military survey, and the eastern coast of the lake is altogether inaccurately delineated. Besides its other imperfections, this chart refers only to the surface of the lake, and is therefore of very little use for the purposes of navigation.

Added to the want of a good chart is the total absence of buoys to mark the shoals and rocks, and the imperfectly lit lighthouses. These are the reasons for the lake having so bad a name, and being considered stormy, full of rocks, and dangerous to navigate.

It was in consequence of a petition presented by the inhabitants of the town of Serdopol, through the late Governor-General of Finland, Count Berg, praying for better charts and greater facilities for navigating the lake, that the Lord High Admiral, President of the Geographical Society, authorised in 1857 a full hydrographical survey of Lake Ladoga, which was commenced the following year by a commission, consisting of but a few persons, and who, though straitened in their finances by a reduction of the grant in 1862 by one-half, or 3600 rubles (500*l.*), have now almost completed their labours.

The following results have been obtained by the hydrographical expedition to Lake Ladoga. Twenty-eight astronomical observations were made with the assistance of the latest scientific discoveries, and in four places magnetic co-ordinates were determined. Topographical drawings were made of the shore-line and islands over an extent of 2548 square versts; * soundings were made along the coasts to a distance of 15 versts from the shore, over an area of 2464 square versts, and also in the middle of the lake, over an extent of 10,000 square versts; maps and plans on a large scale, 100 fathoms to the inch, of the rivers, bays, anchorage, &c., have been sent to the Hydrographical Department, together with seven large volumes of manuscript, giving full particulars of the proceedings of the Commission, and sundry data for hydrographical description. From these materials, charts of the Ladoga Lake are being engraved, and the southern portion of it is already done, as well as maps of the Rivers Volchoff and Svir, the former from its mouth to the rapids, the latter from its mouth to Lodeynaya Polia.

The Ladoga Lake occupies an area of 20,000 square versts (6633 square miles); its extreme length is 196 versts, its extreme breadth 147 versts; its greatest depth is 122 fathoms at a part of the lake west of the island of Valaam, and in the meridian of the town of Serdopol. The incline of its bed is gradual from south to north, commencing at the southern shore with its most shallow part, and gradually increasing in depth towards the north, at first by very slow degrees, but on approaching the northern shore, more rapidly, so that the northern and north-western parts of the lake are the deepest. In this part of the lake the depth of water averages nearly everywhere 60 to 100 fathoms, and the wild lofty cliffs rise perpendicularly from its surface. The average depth of the lake may be stated at 50 fathoms.

The soil at the bottom of the Ladoga Lake consists principally of mud, in as liquid a state as well mixed light-brown paint; some of it, however, is dark brown and dark grey in colour; on the south side of the lake, and near

* A verst is two-thirds of a mile English.

the eastern shore, the bottom is composed of sand of various colours, in some places pure, in others mixed with sand.

Specimens of the soil from different parts of the bed of the lake have been sent to the Academy of Sciences for analysis.

The geognostic formation of the shores of the Ladoga Lake is very varied. The southern shores are generally low, almost treeless and marshy; they are composed of clay, sometimes pure, but generally mixed with sand; in the lower strata the sand is so mixed up with the clay as to be in consistency almost as hard as stone. Judging from the excavations for the new Ladoga Canal, it is probable that the whole low-lying shore of the lake was formed in a long process of time by the alluvial deposits of the rivers falling into the lake. In these deposits are to be found a large quantity of granite stones and boulders of all sizes. The Silurian limestone or flag-stone extends all along the southern shore, but does not approach the edge of the lake. This formation continues for 8 versts ($5\frac{1}{2}$ miles) south of Schlüsselburg, and as far east as Putilovo, a village 4 versts from the lake; it then extends to the village of Lukino, the most elevated ground on the southern shore of the lake; the layers of limestone bear away thence to the eastward to the town of Old Ladoga, and crossing the river Volchoff, continue to the River Siassy, and cross the Pásha. This formation is thus at a good distance from the lake, and only approaches it at one point, viz., at Cape Storjensky, between the Rivers Siassy and Pásha, in the form of a sharp wedge; not far from here, and close to the village of Zagubia, the Svir canal is cut through pure Silurian limestone.

The western shore of the lake from Schlüsselburg to Keksholm is low and clayey at first, except close to the edge of the lake, where it is sandy and rocky; but as it approaches the borders of Finland the shore gradually rises; the soil is pure clay, sometimes covered with sand, and full of stones. Near the islands of Suvando and Taipal there are considerable mounds of argillaceous soil, filled with stones of all sizes. Further towards Keksholm the shore is tolerably high, the soil a mixture of sand and clay, and containing large boulders in rows lying in a north-westerly and south-easterly direction, and bearing the appearance of having been artificially laid one on another. Here too there are similar rows of small stones. Between the two rows the soil is sand and clay, frequently containing small pebbles of a similar kind to those contained in the rows. There are, besides, sandy hillocks of different sizes.

Beyond the river Voksa, 4 versts to the north of Keksholm, the formation of the coast completely changes. From this point the whole northern shore of the lake almost up to the border of the Olonetz Government is one succession of tall cliffs. The mainland and the islands in this part are very hilly, and the wild beauty of the scenery is very striking. The cliffs are in places quite precipitous. The formation here is granite, which, commencing at Keksholm, is light grey in colour and coarse grained, then reddish, and further north dark grey, close grained and very hard.

Thirty versts north of Serdopol is a quarry of marble called Russkelsky. Not far from Serdopol there is also a quarry of graphite, but of inferior quality, and only fit to be used for the manufacture of fireproof smelting-pots. Here, too, on the island of Tulola Sari is found a granite of excellent quality, grey in colour and finely grained, called "Serdobolsky" granite, specimens of which may be seen in the caryatides at the Hermitage, the statue of the Emperor Nicholas, the St. Isaac's Cathedral at St. Petersburg, and in the monument of the 1000th anniversary of Russia at Novgorod.

At the north-east part of the lake the minerals are exceedingly varied. There are small islands composed of pure quartz, spa, schistous flint, and marble. At Pitkerando, in the Lower Oolite system, copper pyrites and tin ore

are found. The mines here, which are sunk to a depth of 70 fathoms below the level of the lake, yielded in the years 1860, 61, and 62, 10,000 poods (3,200 cwt.) of copper and 1000 poods of tin. In 1863, 5000 poods of tin were produced.

The islands of Valaam are in the northern part of the lake, and are about 20 versts from shore. They are remarkable for their natural beauty as well as for their formation. They are all composed of solid stone. It is asserted that this stone is gneiss; but I am of opinion that the Valaam islands have not been sufficiently investigated by geologists.

The small islets of the Valaam group are more particularly interesting, owing to their remarkable formation; they are known by the names of the Holy and the Wonderful Isles respectively. They rise abruptly to a great height from the lake, have numberless fissures in them, and are distinctly divided into parallel strata. The depth of water close to their sides is sometimes 70 to 80 fathoms. The minerals in some parts of Valaam itself crumble away from atmospheric influences into a dark red powder, which fills the hollows and ravines in many places, and is very favourable to vegetation.

The east shore of the lake from Pitkerando southwards is tolerably high, and the soil is clay, except on the borders of the lake, where it is sandy. The argillaceous soil, on passing the Olouka rivulet, takes a south-easterly direction towards Lodeinaya Polia. Near the lake itself pure clay is abundant, and extends all the way to the Svir, and the nearer to that river the more flat and barren is the shore. The border of the lake is pure sand, in some places rocky and covered with dead wood. The eastern shore of the lake has a dreary appearance. The land is flat and monotonous, without a village or any kind of building, not even a fisher's hut is visible from the lake, and the monastery of Ondrussoff, with its church and white stone walls, is the sole object for the eye to rest upon.

Several rivers flow into the Ladoga Lake, and their waters vary much in appearance. The Volchoff pours a brownish red muddy stream into the Ladoga, the water of the Siassy is dark red. The water of the Svir, when it leaves Lake Onega is quite clear, but, after flowing the whole length of its course, and receiving the water of its several small tributaries, it loses the beautiful transparency of the Onega water, and at its mouth, where it unites with the Oyati and Pasha, it likewise becomes dark in colour and indifferent in quality. The water of the Olouka is quite dark and muddy. The rivers and rivulets joining the lake on the north pour into it water impregnated with iron, and of a dark bottle colour. The Taipala, which, after leaving Lake Suwando, breaks through in several places its clay banks and leaves its channel, is of a clayey, almost milky, colour. The streams joining the lake on the low, level, marshy coast of the St. Petersburg district, from the borders of Finland to Schlüsselburg, and from the latter place to the town of Ladoga, are all reddish in colour, muddy and dirty. The Voksa is the only stream flowing into the lake whose water is tolerably clear.

All this water is beautifully cleansed by the Ladoga basin, which supplies the Neva with water, clear, agreeable to the taste, and excellent in every way, particularly during the winter.

The Ladoga draws its principal supply from the Volchoff and the Svir. The former of these rivers, after uniting with the water of the Siassy, flows north through the lake, passing Cape Storjensky, and continuing in a northerly direction. In the same way the water of the Svir, after flowing into the lake, unites with that of the Volchoff, and continues in a northerly direction, gradually undergoing a purifying process, and flows along the east coast of the lake till more than half way up it, when it takes the direction of the centre of the lake, and is merged in the general mass of water.

The waters of the Savolaska and Carelian systems are conducted to the

Ladoga by the Taipala River, and, after joining the lake, flow south to Schlüsselburg, and meet the source of the Neva near its bank.

Thus the lake, after receiving the foul water, full of organic and inorganic matter, with the assistance of winds and waves gradually purifies it. The inorganic matter sinks by degrees to the bottom; objects floating on the surface are, in course of time, washed ashore, and the organic matter is chiefly swallowed by the fish, which abound at the mouths of the rivers and in those parts of the shore where the current is strongest.

Though the water of the Ladoga Lake is particularly clear, the inhabitants along the coast do not use it, owing to the darkness of its colour, caused by the filtration along the banks, excepting that part of the shore between the Taipala and Keksholm; the inhabitants of the islands, however—viz., Valaam, Konevitz, &c., have excellent water.

In the summer of 1864 we had an opportunity of testing the Ladoga water taken from different parts of the lake and at different depths. The first chemical analysis proved this water to be entirely free of salts or alkalies, and to be perfectly distilled by nature, both on the surface and at a depth of 100 fathoms. The transparency of this water is remarkable. Specimens of it, taken from different places and at various depths, have been sent to the Academy for analysis by M. Struve.

The climate of the lake is severe. The fogs in summer are very thick, but of short duration. At night the lake is almost always calm, but particularly so during the summer. The temperature of the water, from the time of the disappearance of the ice to the middle of summer, averages 2° to 3° (heat) Reaumur; in the month of August the water becomes warmer, but does not exceed 5° or 6° . In the more southern portions of the lake the ice begins to form after the first hard frosts, but the lake does not entirely freeze over till late in the month of January, and in some years the middle of the lake remains unfrozen all the winter through.

The ice on the lake is sometimes very thick; but this depends on the severity of the winter. In a severe winter the whole lake freezes, and then the thickness of the ice is 3 or 4 feet; in a mild winter the middle of the lake does not freeze, and the ice-drifts from one side to another of the lake as the wind blows. The floes get packed by the wind, and form dense masses of ice. One, 23rd May, O.S., we measured the ice at a distance of 60 versts from Schlüsselburg, and found it 12 feet thick. This ice was as clear, transparent, and strong, as in mid-winter. The same year a steamer came in sight of Konëvitz on the 16th May, O.S., and was beset by the ice for two days, the thickness of the ice round her being 30 feet. Owing to the low temperature of the water of the Ladoga Lake, the ice remains unmelted a long time during spring, particularly about the northern and north-eastern parts of it, where it drifts about the lake in large masses till the sun's rays melt it altogether. In the spring of 1863, the superior of the monastery of Valaam measured the thickness of a block of ice floating near the monastery, and found it to be 72 feet thick. I have myself been in the northern parts of the lake on the 29th and 30th May, O.S., and my passage has been obstructed by quantities of ice, though in small sharp-pointed pieces. At this time the temperature in St. Petersburg was 20° Reaumur, and many of the inhabitants had gone to their country houses. Icebergs form in the northern part of the lake on the reefs of rocks, and sometimes float off the rocks into deep water.

The shipping on the lake is done by the old-fashioned galleots: 600 of these craft come to Schlüsselburg every year. Their cargoes are chiefly firewood, logs, fir, timber, Carelian birchwood, laths, granite, quartz, spa, marble, graphite, black sand, grindstones, round stones, bones, train oil, butter, bark for tanning, hay, copper, tin, cast iron, wrought iron, salt fish, hides, and many other goods which come by the lake from the Svir. Steamers ply regularly

between St. Petersburg and Svir, also to Keksholm, Valaam, and Serdopol. These steamers take goods as well as passengers from St. Petersburg; but towing lighters across the lake does not seem to flourish, particularly from Svir.

Altogether the navigation of the lake is in a bad state, and has made but very little progress for the last 150 years. As an illustration of the primitive nature of the navigation, the speed of a vessel is determined by burning a tallow candle, and no attention whatever is paid to the rules laid down for navigating.

The masters of the vessels consider keeping charts a work of supererogation; they do not even use the compass properly, and consider its deviation, owing to the influence of iron, as the work of supernatural agency.

10.—*On the Physical Geography of the Queen Charlotte Islands.*

By ROBERT BROWN, F.R.G.S., &c. &c.

FINDING that little is known regarding this interesting group of islands lying off the North-West Coast of America, and a dependency of the colony of British Columbia, I have drawn up this short account, derived almost entirely from observations made during a visit in the spring of 1866.

1. *History of their Discovery.*—These islands were undoubtedly first discovered by Ensign Juan Perez, in the Spanish corvette *Santiago*, on the 25th of January, 1774. La Perouse suspected their separation from the mainland; but it is to Capt. Gray, an American trader, and the discoverer of the Columbia River, that the credit of the first exploration of the coast-line is due. However, it ought to be mentioned that, two years previously (viz., in 1787), Capt. Dixon, commanding the merchant-ship *Queen Charlotte*, of London, had become convinced of their insularity, and applied the name of his ship to the group. Gray, apparently unaware of the prior discovery of Dixon, named them also after his vessel, the Washington Islands or Island, for up to a very recent period this group, now known to be composed of three main islands, were always supposed to be one island, and spoken of in the singular, as, in ordinary parlance, they are still on the north-west coast. Captains Duncan, of the *Princess Royal*, and Douglas, of the *Iphigenia*, about the same period explored portions of the coast, and conduced to our knowledge of their complete insularity. Meares, no doubt, endeavours to secure for Douglas the credit of establishing this point, but I think on insufficient grounds.

Ingraham, in 1791, also visited them and made some explorations. In a work published by him and Dixon, giving a narrative of their voyage, will be found some interesting information about their natural history and the language of the natives. In 1792 Captain Jacinto Caamano, commanding the Spanish corvette *Aranzazu*, cursorily surveyed the northern end of the islands. Since that period they have been regularly visited by traders; the officers of some of which have added a little to our knowledge by surveying some of the harbours and inlets separating the different islands. Under this head the names of Captain G. H. Richards and his officers deserve honourable mention. Of late years the discovery of gold, copper, and coal on these islands, and the establishment of the colonies of Vancouver Island and British Columbia (now united under the latter name) have attracted more attention to the group; though they are still very little known, even on their coast-line, and their interior is entirely unexplored.

During the few weeks which I passed on the islands I was confined almost wholly to Skidegate Bay, the period of the year not allowing of any journeys being made at a great distance, and the Indians declining to travel unless